The Trigger System for STAR at RHIC

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The Solenoidal Tracker at RHIC (STAR) is an experiment designed to study the charged particles produced in heavy-ion interactions at 100 GeV/c per nucleon in the Relativistic Heavy Ion Collider (RHIC) at BNL. The main detector is a Time Projection Chamber, but STAR also includes a Silicon Vertex Detector, a Forward TPC and an Electromagnetic Calorimeter. The UCB group in STAR is responsible for designing and building the system to trigger these detectors. The trigger must:

- Analyze data from every RHIC crossing in the trigger detectors.
- Issue triggers at Level 0 based on the distribution of charged multiplicity and the energy deposited in the calorimeter.
- Abort events, at Levels 1, 2 and 3, based on a more detailed analysis of the trigger detector data and on data from slower detectors.
- Issue triggers to fast detectors (EMC) while the slow detectors (TPC, FTPC and SVT) are busy.
- Inform DAQ when an event is ready to be built and taped.

Within the UCB group we have concentrated on designing and building the custom hardware for the early levels of the trigger and on the control software for the complete trigger system.

Progress during the past year includes the following topics:

We have worked with the STAR Integrations group to define the number of racks and VME crates that the trigger hardware will need on the electronics platform.

Progress was made on the electronics for two of the trigger detector systems - the Central Trigger Barrel (CTB) and the Multi-Wire Chamber (MWC). For the CTB the electronics was redesigned to move it out of the CTB trays and into VME modules on the platform. The new system design is almost complete and board prototyping will begin soon. For the MWC a prototype front-end electronics card was successfully built and tested. The MWC system design is now being finalized to use this card. We also continued discussions with the collaboration about the functionality of the scalar board needed to calculate cross-sections.

Work on the Data-Storage and Manipulation Boards, and the Trigger Control Unit was shut down for 1997 and will be re-started in 1998.

Progress in 1997 also included the trigger software. A new physics program, looking at $\gamma\gamma$ interactions from very peripheral gold-gold collisions was approved for STAR. We have been investigating the effect of these interactions on the trigger system. $\gamma\gamma$ interactions are characterized by very low multiplicity - either 2 or 4 charged particles and no neutral particles. Investigation has shown that at the early trigger level events of this type may be dominated by cosmic rays passing through the TPC. We investigated methods to reject these cosmic ray events in Level 0, either through cuts on which part of the CTB was hit, or through timing cuts on the CTB signals.

During 1997 the STAR Online Group was formed to provide the interface between the user and all of STAR's subsystems. Work this year, with this group, includes defining the online-trigger communications path and the set of commands that can be issued. A start has also been made on defining what information the trigger subsystem needs to put in the STAR database for each run.

Finally, we have begun a detailed review of the STAR trigger control software to prepare for a System Test in June 1998 and a TPC test in October 1998.